PATENT SPECIFICATION

754,141

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The inventor of this invention in the sense of being the actual deviser thereof within the meaning of Section 16 of the Patents Act, 1949, is GERHARD EGGERS a German citizen of Cite Snecma, Batiment E, Decize, Nievre, France.

COMPLETE SPECIFICATION

Improvements in or relating to Jet Propulsion Engines Combined with a Rocket

We, SOCIETE NATIONALE D'ETUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION, of 150 Boulevard Haussmann, Paris, France, a Body Corporate organized under the laws of France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to composite jet propulsion engines of the kind comprising a main power plant operating with ambient air, for example, a jet turbine unit or a ram-jet unit, and a rocket designed to be operated momentarily when a substantial increase in thrust is desired, e.g. during take-off or in combat.

In accordance with the invention, the main power plant comprises an outer wall and an inner wall bounding an air passage, the rocket being housed and extending within the over-all dimensions of the said inner wall and having a rearwardly-facing ejection orifice located at a substantial distance upstream of the propulsion nozzle of the main power plant, whereby the stream issuing from the ejection orifice of the rocket flows through the said propulsion nozzle into the atmosphere. By the term "rocket" as used in this specification we mean the rocket body forming the combustion chamber and ejection orifice, and not the ancilliary gear which may be used outside said body such as fuel pumps and conduits from such pumps to the combustion chamber.

The invention finds a particularly advantageous and simple application in jet propulsion units in which the central portion of the propulsion nozzle is free, a device for controlling the cross-sectional area of the discharge orifice being arranged at the periphery of the said nozzle, which is often the case in modern turbo-jet units in which an after-burning chamber precedes the propulsion nozzle.

In such a case it is possible to arrange the rocket in the axis of the jet propulsion unit, so that the ejection orifice of the rocket is co-axial with the propulsion nozzle, the jet discharged from the rocket thus passing out axially.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 shows in diagrammatic side elevation, with part in longitudinal section, a turbo-jet unit combined with a rocket in accordance with one form of embodiment of the invention.

Figure 2 is a front view of the jet propulsion unit from the air inlet side.

Figure 3 is an axial section of a ram-jet unit including an application of the invention.

In Figure 1, there has been shown a turbo-jet unit of known type including an annular air intake opening 1 and a tubular propulsion nozzle 2. The front portion of the jet propulsion unit contains an axial compressor 3, combustion chambers 4 and a turbine 5 which drives the compressor. On the exhaust side of the turbine extends an exhaust cone which is bounded externally by the casing of the unit and internally by a wall with a conical portion. The exhaust cone leads to a jet pipe 6 which ends with the propulsion nozzle 2 and inside which an after-burning may be effected.

Inside the conical space bounded by the conical wall portion 7 there is mounted the combustion chamber 8 of an auxiliary rocket,

the ejection orifice 9 of which opens towards the propulsion nozzle 2 of the reaction unit and is arranged co-axially with the latter.

It will be understood that this method of mounting of the rocket does not result in any variation of the over-all dimensions of the jet propulsion unit, the rocket being located in a part of the interior which is generally not used or empty. In addition, the jet discharged from the rocket, when the latter is put into operation to obtain an increase in thrust, is discharged axially through the propulsion nozzle 2 and therefore provides a thrust along the same axis as that of the jet propulsion unit. The jet of the rocket, which passes out of the extremity of the nacelle of the jet propulsion unit, is not likely to damage the walls of the cabin, the wings or other members of the aircraft. It may be sufficiently restricted so as not to touch the wall of the propulsion nozzle 2 and to leave a certain annular space between itself and the said wall in order to allow the passage of the jet of the jet propulsion unit.

It is, of course, necessary that the passage area of the propulsion nozzle 2 should be dimensioned so as to permit the discharge of the two jets together when the rocket is set in operation. This nozzle will thus be provided with a control device enabling its area to be reduced to an appropriate value when the rocket is not in operation and when the nozzle has only to discharge the gases from the jet propulsion unit.

There has been shown in the drawing a control device of known type comprising two conical shutters 10 of which surround the outlet of the propulsion nozzle and each of which pivots about studs 11 mounted at right angles to the plane of Figure 1. The pivotal action of the two shutters 10 is synchronised by toothed segments 12 actuated by one or more servo-motors 13. A control device of this kind, being external to the propulsion nozzle, does not interfere with the axial installation of the rocket. The mechanical joints of the system are furthermore protected against the action of the hot gases. The opening and closing of the shutters may be controlled by an automatic regulation which may depend, for example, on the value of the pressure inside the propulsion nozzle on the intake side of the shutters.

The rocket may be of any suitable type.

There has been shown in the drawing a form of embodiment which operates by the combustion of a liquid fuel in a comburant which is also a liquid and which has a powerful oxidising action. The fuel pump 14 and the comburant liquid pump 15 are preferably installed within the over-all length of the inner wall and on that portion of the jet propulsion unit at which the transverse dimension has its smallest value, for example in front of the axial compressor; the pumps may be actuated by a suitable transmission arrangement 16 from the shaft of the compressor, or by other means, for example by small air turbines. These pumps are connected by means of conduits 17 to jets 18 which discharge into the interior of the combustion chamber of the rocket.

If after-burners are to be installed in the jet pipe 6, these burners are arranged in an after-burning chamber so as to leave a free passage for the jet of the rocket in the centre of the chamber. The burners may be arranged in the form of a ring.

In the form of embodiment shown in Figure 3, which is intended to be applied to a ram-jet unit, the casing of which is seen at 20, the air intake orifice at 21 and the exhaust propulsion nozzle at 22, the combustion chamber 8 of the auxiliary rocket is mounted within the interior of a central streamlined fixed body 23 mounted on the axis of the air intake 21 and supported, for example, by radial arms 24. A central body of this kind improves the efficiency of a ram-jet unit at supersonic speeds. The chamber 8 is supplied with comburant gas and fuel through jets 25 which are connected to suitable pumps, not shown. The ejection orifice 9 of the rocket has its opening towards the propulsion nozzle 22 of the ram-jet unit and is in the same axis as the latter. The ordinary burners 26 of the ram-jet unit are arranged so as to leave a free passage in the centre for the jet of the auxiliary rocket.

The forward portion of the central body 23 may be utilised as the cabin for the crew, or may only contain equipment such as pumps, regulators, tanks, etc. . .

Other applications and combinations are equally possible within the scope of the invention. For example, in the case of a propulsion group comprising a turbo-jet unit and a ram-jet unit or athodyd, a rocket may be provided either on the turbo-jet unit or the ram-jet or on both, the principle of the invention being the installation of an auxiliary rocket ahead of the propulsion nozzle of a main jet propulsion unit, whatever type this unit may be.

What we claim is:-

1. A composite jet propulsion engine of the kind comprising a main power plant operating with ambient air and ending with a propulsion nozzle, for example a jet turbine unit or a ram-jet unit, and a rocket designed to supply a substantial increase in thrust, said engine being characterised in that the main power plant comprises an outer wall and an inner wall bounding an air passage, the rocket being housed and extending within the over-all dimensions of the said inner wall and having a rearwardly-facing ejection orifice located at a substantial distance upstream of the propulsion nozzle of the main power plant, whereby the stream issuing

from the ejection orifice of the rocket flows through the said propulsion nozzle into the atmosphere.

2. Engine as claimed in claim 1, characterised in that the ejection orifice of the rocket opens at the rear end of the inner wall of the main power plant and is substantially coaxial with the propulsion nozzle thereof.

3. Engine as claimed in claim 2, characterised in that the main power plant comprises an after-burning chamber located between the ejection orifice of the rocket and the propulsion nozzle of the plant.

4. Engine as claimed in claim 3, characterised in that the after-burning chamber comprises burner elements arranged in ring formation around and outside the flow path of the stream issuing from the ejection orifice of the rocket.

5. Engine as claimed in any of the preceding claims, characterised in that the power plant is a jet turbine unit having an exhaust cone, a jet pipe and a propulsion nozzle in series flow arrangement, said exhaust cone being internally bounded by a conical portion of the inner wall, the rocket being housed inside said conical portion and opening at the apex thereof, coaxially with the propulsion nozzle.

6. Engine as claimed in Claim 5, characterised in that the ejection orifice of the rocket is so designed as to form a jet centrally of the jet pipe, leaving sufficient room thereabout for the flow of the exhaust gas of the jet turbine unit.

7. Engine as claimed in Claim 5 or 6, characterised in that the jet turbine unit the inner wall with the conical wall portion towards the rear of the engine, and a rotary shaft, and the rocket is combined with a fuel pump located within the over-all length of said inner wall and driven from said shaft.

8. Engine as claimed in any of Claims 1 to 4, characterised in that the power plant is a ram-jet unit having a central body bounding with the outer casing of the unit a ramming intake and ending at a substantial distance upstream of the propulsion nozzle of the unit, the rocket being housed inside said body and opening at the end thereof, coaxially with the propulsion nozzle.

9. Engine as claimed in Claim 8, characterised in that the rocket opens into the combustion chamber of the ram-jet unit.

10. A composite jet propulsion engine constructed and arranged substantially as herein described with reference to Figures 1 and 2, or Figure 3 of the accompanying drawings.

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fig: 1

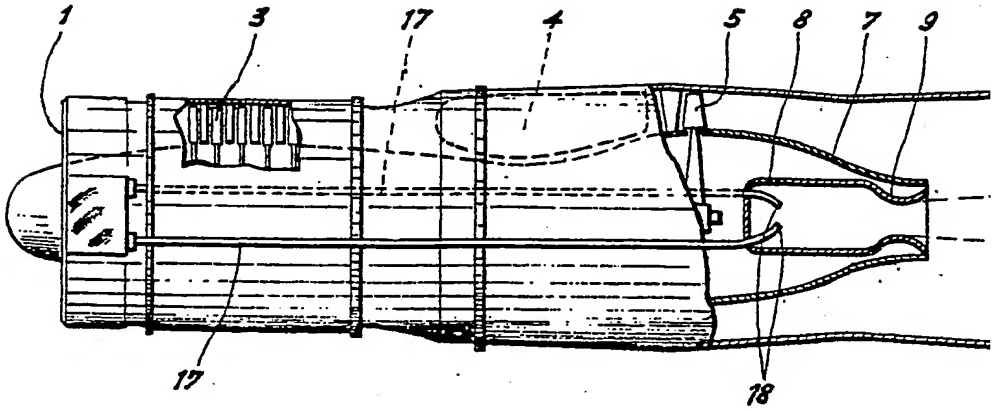
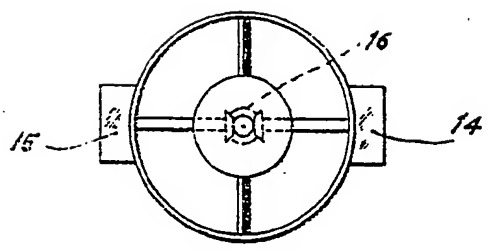
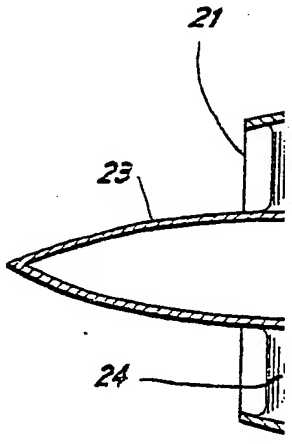


fig: 2





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1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

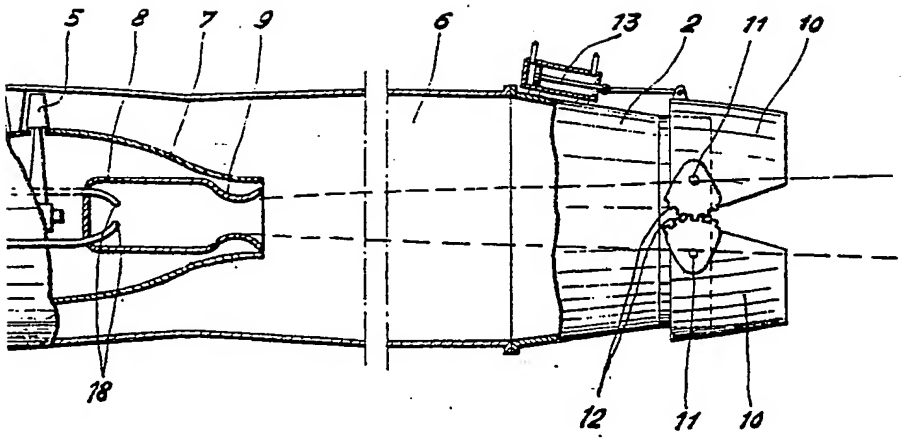

Fig. 3

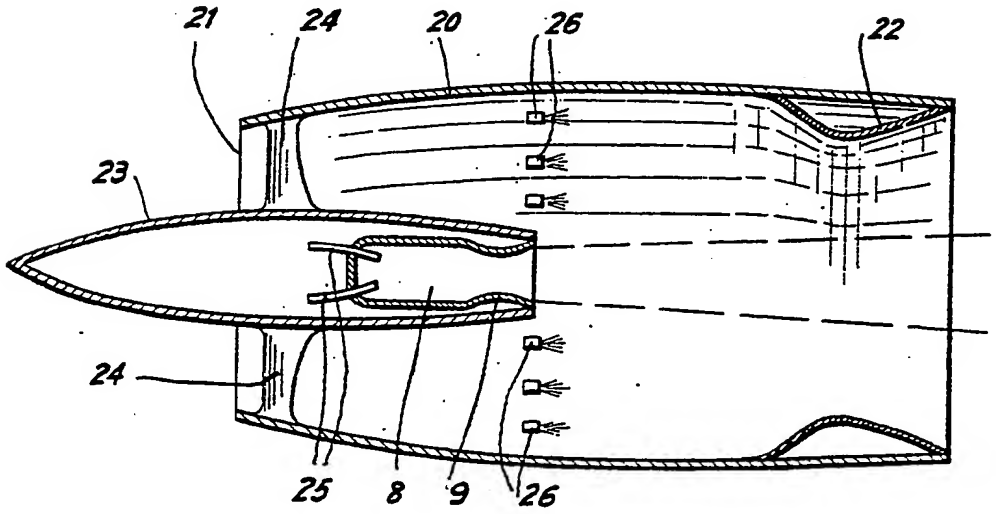

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Fig: 1

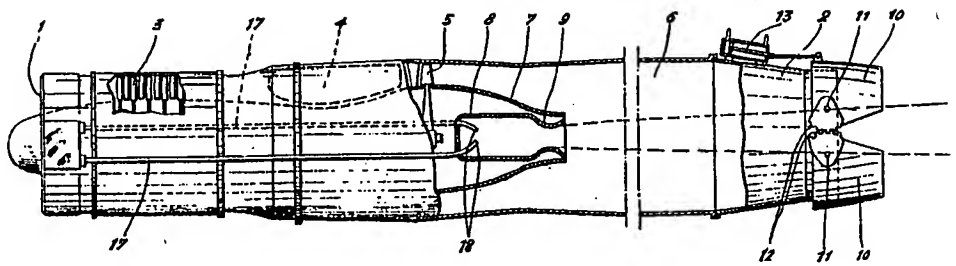

Fig: 2

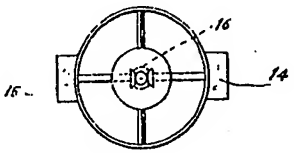

Fig.3